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10/791,247	03/01/2004	Chun-Hsien Lin	67,200-1130	2810

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EXAMINER

CHAUDHRY, SAEED T

ART UNIT	PAPER NUMBER
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1746

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/791,247

Applicant(s)

LIN, CHUN-HSIEN

Examiner

Saeed T. Chaudhry

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-13, 15, 17 and 19-24 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-13, 15, 17, 19-24 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- ☐ Notice of Informal Patent Application
- ☐ Other: ____.

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DETAILED ACTION

Applicant's amendments and remarks filed November 13, 2006 have been acknowledged by the examiner and entered. Claims 5, 14, 16 and 18 have been canceled and claims 1-4, 6-13, 15, 17 and 19-24 are pending in this application for consideration.

New ground of rejection Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
- (c) he has abandoned the invention.
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States.
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.
- (f) he did not himself invent the subject matter sought to be patented.
- (g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

Claims 1-2, 6-9 are rejected under 35 U.S.C. § 102(e) as being anticipated by Inoue et al.

Inoue et al (6,962,161) disclose a method of removing an unnecessary substance on a surface of a work piece by mixing solvent in a mixing chamber (15) and introducing the mixture in the processing chamber to form supercritical fluid of the mixture.

A method of removing unnecessary materials such as resist and so on stuck onto a surface of a substrate in a semiconductor manufacturing process off the substrate and removing therefrom. In a third stage, high-pressure processing such as cleaning and so on is performed. The third stage includes mixing and dissolving the additives, the co-solvent and carbon dioxide; and processing such as the cleaning and the like. First, when the second stage has come to completion, the high-pressure valve 10 is closed, and the high-pressure valves 5 and 13 are opened. Furthermore, from a additives and co-solvent storage tank 11 that reserves the additives and co-solvent, by use of a pump 12, a mixture of the additives and co-solvent is allowed to merge into a carbon dioxide supply line (merging point 14). Subsequently, by going through mixing unit 15, the additives and co-solvent are dissolved in carbon dioxide, and thereby a homogenous dissolution state can be obtained. This is the mixing and dissolving process. The mixture, if necessary, is heated again by a heater 16 and supplied to the high-pressure processing chamber 2. The heater 16 is used when owing to mixing of the additives and co-solvent, a temperature of carbon dioxide is lowered and thereby the supercritical state disappears.

Subsequently, the high-pressure processing such as cleaning and so on is carried out. When the mixture fluid of carbon dioxide, additives and co-solvent is supplied to the high-pressure processing chamber 2, the high-pressure valve 5 is controlled so that a pressure in the high-pressure processing chamber 2 is a pressure same as that of the second stage. Specifically, the high-pressure fluid of an amount substantially same as that of the mixture fluid supplied into the high-pressure processing chamber 2 is extracted from the high-pressure processing chamber

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2, and thereby a pressure in the high-pressure processing chamber 2 is maintained at a constant value.

As the third stage is continuously carried out, supercritical carbon dioxide therein the additives and the co-solvent are homogeneously mixed and dissolved is supplied constantly in a clean state to the high-pressure processing chamber 2 and comes into contact with a surface of the workpiece 3 such as wafers. Then, unnecessary materials are dissolved from a surface of the workpiece 3 into a cleaning fluid and removed. The high-pressure fluid that is contaminated by dissolving the unnecessary materials, without remaining in the high-pressure processing chamber 2, is exhausted from the high-pressure processing chamber 2. Accordingly, the third stage that performs the cleaning and so on can be carried out stably and in a short period of time.

Here, as the additives, fluorides can be preferably used in order to remove also polymer contaminants such as resist and etching polymer stuck to a semiconductor substrate. Fluorides very thinly dissolve a surface of the workpiece 3, and, owing to a lift off effect, unnecessary materials on a surface of the workpiece 3 are excellently removed.

As specific examples of the fluoride, ammonium fluoride (NH_4F), quaternary ammonium fluorides containing nitrogen atom and hydrogen atom such as tetramethylammonium fluoride, tetraethylammonium fluoride, tetrapropylammonium fluoride, tetrabutylammonium fluoride, and choline fluoride $[\text{HOCH}_2\text{CH}_2\text{N}(\text{CH}_3)_3]^+\text{F}^-$ can be cited. The fluorides have excellent cleaning power. Depending on the kind of the workpiece, fluorides further containing carbon atom (for instance, among the above cited compounds, compounds other than ammonium fluoride) are more effective. Polyalcohols such as polypropylene glycol may be used as the

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additives together with the fluorides.

Depending on the kind of the workpiece and the kind of the unnecessary material, the kind of the additives may be altered; quaternary ammonium hydroxides such as TMAH (tetramethylammonium hydroxide), alkylamines, alkanolamines, hydroxylamines (NH.sub.2 OH), xylenes, methylisobutyl ketones and fluorinated polymers may be used as the additives.

The additives can be dissolved with difficulty in supercritical carbon dioxide; accordingly, by using in combination a co-solvent that can be a dissolution auxiliary, a homogeneous cleaning fluid (mixture fluid of the additives, the co-solvent and carbon dioxide) can be obtained. Although the co-solvents are not restricted to particular ones as far as the additives and supercritical carbon dioxide are made compatible, aliphatic alcohols, in particular, aliphatic alcohols having one to three carbons such as methanol, ethanol, isopropanol and so on can be preferably cited. This is because that these substances dissolve easily in supercritical carbon dioxide; accordingly, by controlling an addition amount thereof, the cleaning power can be controlled. One kind or two or more kinds thereof may be mixed and used (see col. 5, line 9 through col. 6, line 26).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 148 USPQ 459, that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or unobviousness.

Claims 3-4 are rejected under 35 U.S.C. § 103 as being unpatentable over Inoue et al.

Inoue et al were discussed supra. However, the reference fails to specify the contacting time.

It would have been obvious at the time applicant invented the claimed process manipulate the time of treatment of the substrate with supercritical fluid for better and efficient results without undue experimentation.

Claims 10-13, 15, 17, and 19-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue et al in view of Morita et al and Vaartstra et al.

Inoue et al were discussed supra. However, the reference fails to disclose cleaning conductor and conductive layer.

Morita et al (2002/0083959) disclose a method for removing foreign matter from an object to be processed, wherein the foreign matter is removed by exposing the object to a fluid kept in a supercritical or subcritical state, the fluid dissolving the foreign matter (see claims). The inventive method is applicable to removing foreign matter from not only the dielectric film in a semiconductor device but also a conductor film or a semiconductor substrate in a semiconductor device or a component in a device of any other type. This is because the same effects may be attained in those cases under appropriate conditions [see paragraph 0089].

For example, an Mn film may be formed by using only Mn(DPM)₂ as a material for the metal organic film and reducing and dissolving Mn(DPM)₂ on the substrate with the reaction chamber kept in the supercritical or subcritical state in the presence of a reducing material such

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as carbon dioxide or a mixture of carbon dioxide and NH_3 . The gate electrode of the MFISFET shown in FIG. 6(c) or that of an ordinary MIS transistor may be made of a metal such as aluminum or tungsten by doing so. Also, an MFMISFET may be formed by interposing a conductor film between the gate insulating film 28 and ferroelectric layer 29 and used as a nonvolatile memory device. In that case, the conductor film may be made of a metal such as Pt or Ir or a metal oxide such as IrO . By providing one of these conductor films, it is expected that the crystallinity of the ferroelectric layer 29 to be formed thereon would further improve [see paragraphs 0133-0134].

Vaartstra (6,242,165) discloses to remove organic material from a substrate with solvent in supercritical state. Wherein the substrate has doped and undoped semiconductors.

It would have been obvious at the time applicant invented the claimed process to incorporate the cited steps of cleaning the semiconductor having conductor and conductive layer with supercritical fluids as disclosed by Morita et al into the process of Inoue et al for the purpose of removing foreign material from the surface. Further, Vaartstra discloses to remove organic material from a substrate with supercritical fluids, wherein the substrate include doped and undoped semiconductors. Therefore, one of ordinary skill in the art would have used the teaching of Vaartstra into the process of Inoue et al for cleaning P or N doped regions.

Applicant's arguments with respect to claims 1-4, 6-13, 15, 17, 19-24 have been considered but are deemed to be moot in view of the new grounds of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Saeed T. Chaudhry whose telephone number is (571) 272-1298. The examiner can normally be reached on Monday-Friday from 9:30 A.M. to 4:00 P.M.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Michael Barr, can be reached on (571)-272-1414. The fax phone number for non-final is (703)-872-9306.

When filing a FAX in Gp 1700, please indicate in the Header (upper right) "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communication with the PTO that are for entry into the file of the application. This will expedite processing of your papers.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (571) 272-1700.

Saeed T. Chaudhry
Patent Examiner



MICHAEL BARR
SUPERVISORY PATENT EXAMINER